The Predictor

Iteration 5 Substep 1 **June 1998**

A NEWSLETTER FOR THE NPARC USERS ASSOCIATION

From the Support Team

The new NPARC Alliance flow solver (WIND) was released on February 13, 1998. Many existing NPARC users have started converting to WIND. As of the end of May, sixty-five requests for the new NPARC Flow simulation software had been received and processed. If you haven't requested WIND yet, since it is an entirely new package, the NPARC Support team is requiring a new Memorandum of Agreement (included at the end of the newsletter) be completed. One additional requirement has been added to the Memorandum of Agreement. Non-government requestors must be registered as a "certified contractor" with the Defense Logistics Services Center (DLSC). The DD form 2345 must be completed to obtain an export control number. The DLSC can be contacted via the internet at http://www.dlsc.dla.mil or at 1-800-352-3572.

A training class on the structure and use of WIND will be offered to the user community late summer 1998. Watch for more details to be posted on the WWW site. Please send questions and inquiries about this training to the email address below.

What's Inside

Support for NPARC v3.0 and v3.1 is scheduled to continue at least through the end of 1998.

To let us know what you think or for support questions, the NPARC support team can be contacted at:

e-mail:
nparc-support@info.arnold.af.mil

phone:
(931)-454-7455

fax:
(931)-454-6658

WWW:
http://info.arnold.af.mil/nparc

CFD Leaders Gather for April Fools Day (And the 4th Annual NPARC Alliance Workshop)

The AEDC Gossick Leadership Center was again the gathering place for the Annual NPARC Alliance Workshop. With 36 participants representing 14 different organizations, the 4th Annual NPARC Alliance Workshop was the largest on record! The workshop ran from the morning of Mar 31st to noon on the 2nd and included only one minor prank in

honor of April Fool's Day. (Yes it involved Legos®!)

Each year at the annual workshop, the Alliance seems to find itself at a crossroad, reshaping its structure and refining its path. This year proved to be no different. One major theme at the workshop was exploring ways to expand the alliance through increased participation of other government, industry and academic organizations. To date the major Alliance players have been NASA LeRC, AEDC and Boeing (Seattle and St. Louis). This year some of the new workshop participants included the Air Force Research Lab, NASA Langley, NASA Ames, Lockheed Dallas, Lockheed Ft. Worth, the Rockwell Science Center, Allison, UT and MSU. We have formed a team to follow up on suggestions made at the workshop to possibly restructure the Alliance to include wider and more direct participation by these organizations in the near future.

Another theme at the workshop was how to move the system of Alliance codes to a more modular framework that would make transition of new technologies even easier. This new "Framework" should allow for incorporation of unstructured as well as structured grid use in the future.

Of course, we constructed the plans and policy document for the Alliance that will cover the next two years of our activities. This has proven to be invaluable to the Alliance overall and provides a touchstone for the conduct of our work until we meet again next summer and refine it all again.

Overall, the Workshop was a BIG SUCCESS and involved a much wider scope of participants than in the past. We are following up on several ideas that will no doubt change the Alliance for the better!

WIND 2.0 Goal: Efficient, Time-Accurate Simulations

The development team has received a lot of feedback from users since WIND 1.0 was released in February and is working to improve the existing features and add new ones to meet the expressed needs. While improving current features is an important aspect of development, the focus for version 2.0 is on efficient, time-accurate simulations. Capabilities currently being incorporated include:

- Improved global Newton
- Gauss matrix inversion algorithm
- Second-order time accuracy
- Wall functions

Other improvements on aspects of the code related to stability and accuracy when taking large time steps are also being pursued. The goal is to improve the accuracy while decreasing the turn-around time for an unsteady simulation by one to two orders of magnitude.

The HPC CHSSI program is providing funding to improve the efficiency of WIND on parallel computer architectures. A method for automatically decomposing the grid domains into smaller blocks has been developed and will be implemented. This approach will allow load balancing, increasing the parallel efficiency for steady-state and time-accurate simulations (see related article “Adding More Parallel Capability to WIND”).

Other capabilities currently under development include; improved boundary condition specification, improved graphical user interface for grid and solution processing, and improved chemistry algorithms. As always, comments and suggestions from the user community are sought and appreciated.

The “NEW” Validation Archive

The NPARC Web site is being updated regularly to reflect the many changes taking place within the Alliance. One of the changes is found in the Validation pages. Previously, for the NPARC code, the Validation archive was presented in a simple table-like fashion. That is, the files were simply stored on a web server, and the user was presented with a table-of-contents of files, which he or she could download for further inspection. These included separate files for grids, code input, solutions, experimental or analytical data, special purpose pre- and post-processing codes, and analysis documents. A simple README file usually provided a basic problem description. While this mode met basic needs, it was not very sophisticated, nor did it take advantage of the modern features and capabilities of the World-Wide-Web.

A new set of Web pages is in development for documenting the results of the WIND validation. The top level page summarizes the Alliance Validation effort, and provides links to the remainder of the Validation archive, including descriptions of the policies and plans and of definitions critical to the Alliance efforts. Two links yield a basic definition of validation and a description of the ideal validation

process. The Case Archive itself is described on another linked page; further links go to a Table of Cases, Case Abstract summaries, and a Feature Cross-Reference Table. The purpose of the latter table is to show which features of WIND are tested in which cases. The Table of Cases lists all the cases that have been run with WIND to-date, as well as a number of the NPARC cases that are of high priority for WIND. The goal is to include all of the NPARC validation cases in the new WIND validation archive, with new cases continually being sought to validate features of WIND that are new relative to NPARC.

As previously, the cases are categorized as model, example, and check cases, depending upon the completeness of the validation effort. In addition, the cases are described as either "unit" or "configuration-oriented" based upon the complexity of the geometry and flow. A further description is the "Basis" which may be experimental, analytical, computational, or none.

The web page for each case is intended to follow a similar format; to facilitate that goal an HTML Template page is linked from the Validation home page. In essence, this page contains the information previously included in the old README file. However, the new format is more visual, including pictures as well as text. Typically, the page includes a color flow field graphic, a geometry or grid image, and (hopefully!) a comparison figure of the WIND solution with data and possibly NPARC (or other state-of-the-art codes). Input parameters and file descriptions or listings, boundary condition summaries, and solution strategies are usually included. Post-processing descriptions, data comparison discussions, and description of sensitivity studies are desirable, where pertinent. Finally, appropriate references are listed, and a contact point (with e-mail link) is given for the responsible party. One additional note is that all files relative to each case that an interested party might want to see are included in a Unix compressed tar file, rather than a table of individual cases. This single file can be downloaded as "*casename.tar.Z*" by anyone who wishes more detail, wants to further post-process the solution, or intends to run the case.

WIND users are encouraged to submit their own validation cases to the Alliance using this template to facilitate timely publication of their results. In the future, we would like to automate this submittal process; software tools to allow this automated submittal are currently being sought.

Check out the new Web pages for yourself from the NPARC Alliance home page under "*Validation*" or go directly to:

http://www.lerc.nasa.gov/www/wind/valid/validation.html.

We are always looking for suggestions as to improvements. Send your comments and suggestions to nparc-support@info-arnold.af.mil. Contact the Validation Team Coordinators (John Slater at NASA LeRC, and Ken Tatum at AEDC) to contribute to the validation effort.

Virtual Development Team Using IVMS

The NPARC Alliance development team has grown in the number of developers and in the number of geographically distinct locations. While version control has always been an important policy of the development team, its importance is magnified as the number of contributing organizations increases. The NPARC code was managed under a version control system only at AEDC. Changes from NASA LeRC or elsewhere had to be sent to AEDC for inclusion in version control, often leading to conflicts that had to be resolved. This approach is no longer acceptable.

Boeing in St. Louis has developed, as part of their own internal research and development effort, an Internet Version Management System (IVMS) that allows individuals to access the version controlled source and libraries via any compatible internet browser. The underlying system is RCS, a standard version control system for UNIX platforms. IVMS provides a GUI interface to RCS, which executes on the host machine.

A secure entry is required to IVMS, allowing multiple levels of users and developers. Normal users of the code will soon be allowed to enter the site to download the latest version or to download the source code for viewing purposes. Developers may access the source and libraries of the version currently in development. The source can be downloaded for viewing only or can be checked-out and locked to block other developers from accessing the same routines. Administrators can check in the

object libraries in order to keep these up-to-date.

With this new tool, the NPARC Alliance is truly moving toward a national virtual development team for the WIND code and other supported computational tools.

WIND Documentation

Documentation for WIND is generally available in both PostScript (generated using LaTeX 2e and dvips, and intended for printing) and HTML form (intended for interactive use). Much of the WIND documentation is based on documentation originally developed at McDonnell Douglas Aerospace Company for the NASTD code. The WIND documentation is available on the World Wide Web, at http://www.lerc.nasa.gov/www/winddocs.

There are two levels of WIND documentation - one aimed at users and one at developers. The user-level documentation is what a typical user will probably refer to most often. It includes information that a user, from beginner to expert, will need to successfully apply the program to real-world problems. The developer-level documentation contains detailed reference information that a developer can refer to when modifying or extending the program.

User-Level Documentation

The principal user-level documentation is the "WIND User's Guide". It describes the operation and use of the WIND code, including: 1)a basic tutorial; 2)the physical and numerical models that are used; 3)the boundary conditions; 4)convergence monitoring; 5)diagnostic messages that may be printed; 6)the files that are read and/or written; 7)execution scripts and parallel operation; 8)a complete list of input keywords and test options and 9)where to go for additional help. A separate "Guide for Translating between NPARC and WIND Boundary Conditions" is available to help current NPARC users in transitioning to the new WIND code.

Separate user's guides are available for GMAN and CFPOST. GMAN is the interactive menu-driven pre-processor used to specify boundary condition types and zonal connectivity in multi-zone grids. An airfoil/flap example case shows how to use GMAN to cut holes, define fringes, and set boundary conditions for Chimera, or overset, grids.

CFPOST is a post-processor that may be used to examine the contents of the Common Flow (.cfl) file created by WIND. It includes: 1)options to list and plot results, 2)generate reports, and 3)produce Plot3d files for use by other post-processors.

A "WIND Installation Guide" is also available, which may help when installing the WIND code and its associated pre- and post-processing tools.

Developer-Level Documentation

The principal developer-level documentation for WIND is the "WIND Developer's Reference". A preliminary and incomplete version of this documentation is currently available, with a more complete version scheduled for release with Version 2 of the WIND code in early 1999. The current version includes information about the development environment; the program structure; the parallel implementation; lists of all the Fortran parameters and common variables, with definitions for a few of the more important ones; and a list of all the subprograms, including a one-line summary of the subprogram's purpose, the argument list, the name of the file the subprogram is in, a list of the subprograms that it calls and that call it, and a list of the common blocks that it includes. It does not yet include detailed descriptions of the work done in all the subprograms.

A "Common File User's Guide" is also available, describing the common file structure and the library routines used to access and store information in common files.

Due to export control regulations, the "WIND Developer's Reference" is only available to registered WIND code users and developers. Contact the NPARC Support team (nparc-support@info.arnold.af.mil, or 931-454-7455) for details.

Adding More Parallel Capability to WIND

WIND version 1.0 has a very robust and capable scheme for running in parallel. It assigns each computational zone to a processor and uses the PVM (Parallel Virtual Machine) library to communicate among processors. If a processor fails or is taken off-line for some reason, there is built-in fault tolerance which allows any zones assigned to the failed processor to be moved to other processors. The parallel capability does not add any overhead to the non-parallel execution of WIND; in fact, the parallel module can be replaced by a set of fake routines if executable size is a concern for serial runs.

As one of the High Performance Computing Modernization Program's CHSSI projects (see the Corrector 4.2), the NPARC development team

is working to add more parallel scalability to WIND for highly parallel machines, such as the Cray T3E, IBM SP, and SGI Origin 2000, as well as for clusters of workstations. The primary focus of this work will be to automate the capability for multiple processors to work on a single zone, which will allow for a better balancing of the workload across the available processors. This balancing will occur at run time. A secondary part of this effort is the development of a version of WIND's parallel module, which uses the MPI (Message Passing Interface) Standard, to compare its performance to the PVM version on highly scalable parallel machines.

The WIND scalability effort is being worked by the Air Force Research Laboratory, the Boeing Company, and AEDC. Steve Scherr of AFRL/VAAC is the point-of-contact. Development will continue during 1998, with full implementation expected in WIND version 3.0.

User Association Meetings

The 11th NPARC User's Association Meeting was held in conjunction with the AIAA Aerospace Sciences meeting in Reno, NV, January 1998. The meeting was the Alliance largest user's meeting yet with approximately 50 in attendance. A review of the status of the Support, Development and Validation activities were presented. A brief history describing how and why the WIND code was conceived, the development approach taken to combine the capabilities of the three codes, NPARC, NXAIR, and NASTD, and a list of expanded capabilities for WIND. The item receiving the greatest attention was the development, capabilities, and upcoming release of the WIND code.

Several pre and post-processing vendors were in attendance and stated that their tools would be modified to read or write the WIND common formatted files (CFF). These vendors included representatives from Intelligent Light, Computational Engineering International, Pointwise and ICEM CFD Engineering. Intelligent Light has agreed to provide a WIND specific version of Fieldview to WIND users at no charge for one year. We are working with other vendors to make similar arrangements. Please contact the NPARC support team for more details.

The following is a list of upcoming NPARC User's Association meetings:

January 1999

AIAA Aerospace Sciences Meeting
Reno, NV

One NPARC Technical Session

NPARC User's Meeting

June 1999

AIAA Applied Aerodynamics Conference
One NPARC Technical Session

NPARC User's Meeting

Please plan to attend one of the User's meetings to let your views be known. You are also encouraged to contribute to the NPARC Alliance technical sessions to communicate your experiences to other users.

Frequently Asked Questions

The following are some of the more frequently asked questions of the user support team.

How do I get a copy of the new flow solver, WIND that is supported by the NPARC Alliance?

To receive the WIND code, all NPARC users are being asked to resubmit a new Memorandum of Agreement. The form has been included it with this newsletter or you can send the NPARC Support team your fax number and it will be faxed to you.

What platforms does the NPARC flow simulation software currently execute on?

Currently the NPARC flow simulation software executes on the following hardware platforms:

SGI Origin 2000

SGI workstations running IRIX 5.3-6.4

SPP2000

Convex C4

CRAY C90

HP workstations

SUN Ultra

Linux

The NPARC flow simulation software does not currently execute on a PC running Windows but the port to this platform is underway. Check the "HOTNEWS" located on the NPARC WWW's home page for late breaking information.

How can I set multiple boundary conditions on a plane using

GMAN?

First, select the boundary you want to work on. Then, set the entire plane to the boundary condition that is most used on that plane. In graphical mode, click on the words "Work Subarea" in the lower right corner. You may now either specify the coordinates describing the corners of the sub-area or click on the corners using the mouse. Enter coordinates using spaces and delimit with <cr>, e.g. to specify the region 1,1 to 3,5 on the current I plane enter 1 <space>1 <cr> 3 <space> 5 <cr>. In text mode type the keyword "SUBAREA" followed by the range, e.g. SUBAREA J1 J3 K1 K5. Now any operation you perform only affects this sub-area. Be careful to set the sub-area back, if you wish to operate on the entire plane.

Where can I get example input and grid files to try WIND out?

There are two places to go. For first time users, it is suggested that you work through the tutorial problem in the WIND documentation on the WWW. You can get to this page from the NPARC home page or directly at http://www.nasa.lerc.nasa/www/winddocs. There are instructions and files that can be downloaded. There is also a hole-cutting tutorial in the GMAN manual available from the same page.

You can also get information and files on more complex validation cases. These can be accessed from the NPARC home page or directly at http://www.nasa.lerc.nasa/www/wind/valid/validation.html.

GMAN does not read my grid file after switching to graphics mode. What am I doing wrong?

The version of GMAN for the SGI 5.3 operating system has a minor bug. To work around this bug, read the file in first with the command, "file filename.cgd", then switch.

Where can I get more information on how to use the new NPARC flow simulation software and the status of reported problems?

We now have several sources of information on the NPARC web site to keep users up-to-date. Under *HOTNEWS*, the user can find late breaking information on the software and the Alliance. In the same area, a set of Frequently Asked Questions is maintained. Two other links are available from the home page to update the user on current problems and solutions, as well as the status of new capabilities.

NOTES

Memorandum of Agreement

AEDC Software Release

U.S. Government

Date:

1. On behalf of the U.S. Government agency listed below, I request release of the following US Air Force software package (computer programs, system description, and documentation):

Distribution format and media:

The requested software package will be used as follows:

2. I understand that the requested software package contains technical data whose export is restricted by the Arms Export Control Act (Title 22, U.S.C., Sec 2751, *et seq*) or Executive Order 12470, and that violations of these export laws are subject to severe criminal penalties. Further dissemination of this software is controlled under DoDD 5230.25 and AFI 61-204, and is limited to object or executable code.

Requester

Signature:
Printed Name:
Requesting Organization:
Address:
City, State and ZIP Code:

Requester: Technical Contact

Name:
Phone Number:
E-Mail Address:

AEDC OPR Certification / Verification

Name, Initials, and Date:

AEDC Software Release Authority

Signature:
Printed Name:
Test Operations Directorate Arnold AFB, TN 37389-9010

Memorandum of Agreement

AEDC Software Release

U.S. Commercial & Educational and Canadian Organizations

Date:

1. I/we the undersigned, on behalf of the Requesting Organization listed below (hereafter referred to as the "Requester"), request release of the following US Air Force software package (computer programs, system description, and documentation, collectively, the "Package"):

Distribution format and media (default - electronic dissemination via Internet, FTP, etc.)

The requested software package will be used as follows:

2. I/we understand that the Package may be subject to limited rights or other restrictions or constraints. In consideration therefore, the Requester agrees:

   a) The Requester shall not knowingly release or disclose the Package to third parties (other than the Requesting Organization).

   b) To strictly abide by and adhere to any and all restrictive markings placed on the Package.

   c) That any restrictive markings on the Package shall be included on all copies, modifications, and derivative works, or any parts or options thereof, in any form, manner or substance, which are produced by the Requester including but not limited to incorporation of the Package into any other data, technical data, computer software, computer software documentation, computer programs, source code, or firmware, or other information of like kind, type or quality. In all such events, Requester shall clearly denote where such Package derived data initiates and concludes by use of annotations or other standard markings.

3. The Requester and the Software Release Authority agree that:

   a) No guaranties, representations, or warranties either express or implied shall be construed to exist in any language, provision, or term contained in these materials or in any other documentation provided herewith (all such items are collectively referred to as the "Agreement"), and furthermore, the releasing organization disclaims and the Requester waives and excludes any and all warranties of merchantability and any and all warranties of fitness for any particular purpose.

   b) The Requester shall obtain from the releasing organization all of the Package (defined in paragraph 1 above), or any other products or services contemplated by the Agreement, in an "as is" condition.

4. The Requester's use of the Package shall not prevent the Government from releasing the Package at any point in the future.

5. The Requester shall not offer the released Package or any modified version thereof for resale to the Government, in whole or as part or subpart of a Government deliverable, without explicitly stating that he is

doing so by providing certification documentation (e.g., Section K of the Government solicitation) to the contracting officer before contract award.

6. The Requester may use the released Package in a contract with the Government, but understands that the Government shall not pay the Requester for rights of use of such Package in performance of Government contracts or for the later delivery to the Government of such Package. The Requester may be entitled to compensation for converting, modifying, or enhancing the Package into another form for reproduction and delivery to the Government, if authorized under a contract with the Government.

7. The Requester is not entitled to any released Package that is subject to national defense security classification or the proprietary rights of others. The Requester shall report promptly the discovery of any such restricted material included with the Package to the US Air Force Software Release Authority below, and will follow all instructions concerning the use, safeguarding, or return of such material. The Requester shall not copy, or make further study or use of any such material later found to be subject to such restrictions.

8. I/we understand that the Package received is intended for domestic use (US and Canada) only. It will not be made available to other foreign owned or controlled corporations, or other foreign governments; nor will it be used in any contract with another foreign government.

9. The Requester and the Software Release Authority intend that all agreements under this Memorandum of Agreement shall be governed by the laws of the United States of America.

10. The undersigned Requester has the authority to bind the requesting organization to the terms of this Agreement.

Requester

Signature:
Printed Name:
Requesting Organization:
Address:
City, State and ZIP Code:

Requester: Technical Contact

Name (if different from Requester):
Phone Number:
E-Mail Address:

AEDC OPR: Export-Control Info

Export Control Number & Expiration Date::
Data or Document Custodian's Name:
Phone Number:
E-Mail Address:

AEDC OPR: Certification/Verification

Name, Initials, and Date:

AEDC Software Release Authority

Signature:
Printed Name:
Test Operations Directorate Arnold AFB, TN 37389-9010